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Arnold successfully tests 'one-of-a-kind engine'

by Tina Barton, Arnold Engineering Development Center Public Affairs

ARNOLD AIR FORCE BASE, Tenn. — April 3 marked the first operational test of a new Pratt & Whitney Advanced Experimental Turbine Engine Gas Generator, and another Arnold Engineering Development Center (AEDC) success, as it continues further testing.

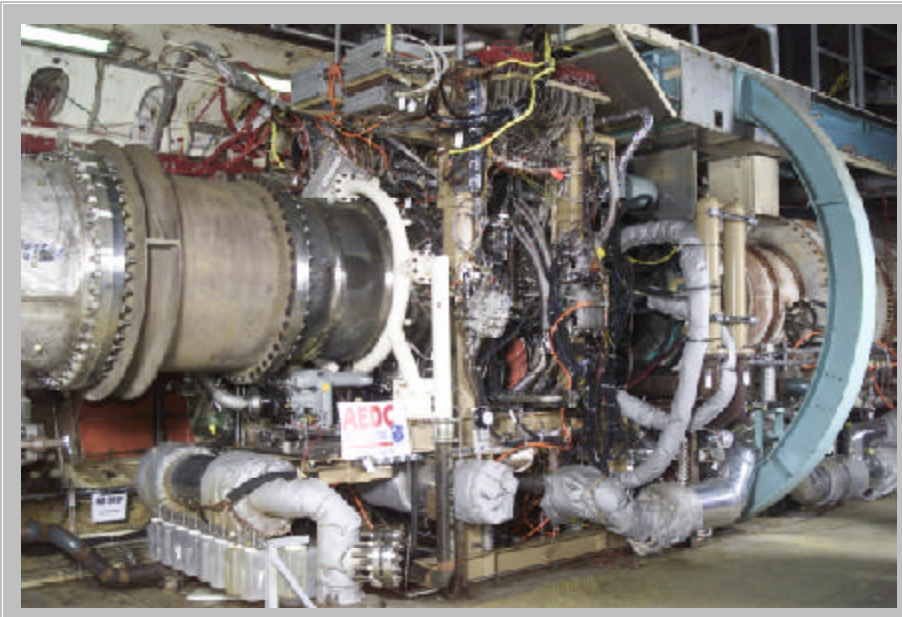
The Pratt and Whitney XTC67-1, an experimental turbine engine gas generator, successfully completed initial operational checkouts including starting and operation at idle conditions, and preparations continue to expand operations to full power conditions.

The engine was built to demonstrate the latest technologies and goals derived from the Integrated High-Performance Turbine Engine Technology (IHPTET) program.

The engine core, or gas generator, is part of the entire turbine engine that consists of a high-pressure compressor, combustor and high-pressure turbine.

"This is a one-of-a kind engine," said Frank Araneo, AEDC project manager.

"Engine manufacturers are incorporating technologies from the IHPTET program into the latest production engines including the F100, F110, F414, F119 and F-35 Joint Strike Fighter (JSF 135) engines. These technology efforts result in improved life, durability and performance of fielded engines, ultimately reducing the cost of operations and ownership," Araneo said.



The Pratt and Whitney XTC67-1 experimental turbine engine gas generator completed its first successful test in the Arnold Engineering Development Center's Propulsion Development Test Cell J-1. The purpose was to demonstrate the Integrated High-Performance Turbine Engine Technology (IHPTET) program goals and to reduce the risk of the follow-on test of the Joint Technology Demonstrator Engine XTE67 engine by demonstrating the acceptable performance and operation of the core before installation in the complete engine. (Air Force photo by David Housch)

"Cycle operating temperatures are being increased while, at the same time, maintenance and operating costs are being reduced. This is primarily due to significant component durability and efficiency improvements and reduced weight and parts count," Araneo said.

According to Richard Moore, AEDC test project manager, J-1 simulates the environment of a complete engine as if it contained the core.

"When the core engine passes the tests, the Pratt & Whitney team will build up a complete engine consisting of the core, fan, a low-pressure turbine and an exhaust nozzle," Moore said. "Then, the built up engine will be tested at another facility."

To meet the latest technology demonstration requirements, AEDC employees completed special upgrades to the high-pressure in-bleed and out-bleed systems.

The in-bleed system provides regulated high-pressure and high-temperature air used for compressor stall line definition testing. AEDC's Von Karmon Gas Dynamics Facility generates the high-pressure air, and the upgraded T3 heater heats it.

The upgrades included new pressure regulating stations, new convection boxes on the T3 heater and new in-bleed piping to handle higher temperatures and pressures," Moore said.

"The out-bleed system piping was completely redesigned, and new piping was fabricated by AEDC's Model Shop to handle the higher bleed discharge temperatures and pressures expected for the core engine test. Because of its design, the out-bleed system will also handle future core engine out-bleed requirements," Moore added.

Other system work includes reactivation of a high-flow/high-

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pressure water pump, expanded instrumentation systems to measure high-pressures, a new throttle system and an improved strain gage conditioning system.

"To meet the unique pressure requirements, we mounted three 750-psi pressure measurement modules inside the test cell on the engine stand near the test article rather than outside the test cell in an air-conditioned room," Moore said.

"Before the upgrade, pressure lines were routed up to 100 feet from the engine and through the test cell wall into an air-conditioned room where the modules were housed and connected electronically to the measurement system computer. Now, only the electrical cable goes into the test cell, making installation much simpler and less expensive while maintaining measurement accuracy."

In a parallel process to the facility upgrades, AEDC's Applied Technology Group integrated the Non-interference Stress Measurement System with the Computer Assisted Dynamic Data Monitoring and Analysis System to allow customers real-time, online access to data as they are generated.

"The resulting new stand-alone Gen IV system allows AEDC and its customers to complete more advanced processing," said Don Gardner, a coach in the Applied Technology Instrumentation and Diagnostics Branch.

The ATEGG test will demonstrate the accuracy of the NSMS Gen IV system.

"Test results from this aeromechanical stress survey will provide valuable data for the manufacturer," Araneo said. "The survey will define airfoil flutter boundaries, confirm airfoil resonant responses and demonstrate acceptable vibratory stress levels." **@**